

REMARKS

New claims 15-17 have been added so that claims 1-17 are now in the application. Claims 8-14 have been withdrawn from consideration. It is believed that the Examiner intended to include claim 14 as a withdrawn claim.

The Examiner objected to the abstract of the disclosure on the basis that it refers to a non-elected method. The abstract has been rewritten to pertain to the elected article claims herein.

The Examiner objected to claims 1, 4 and 6 on the basis that there is no antecedent basis for "the first lead layer" and "the second lead layer". These phrases have been amended as suggested by the Examiner.

Claims 1-7 were rejected under 35 USC 112, second paragraph, as being indefinite. The Examiner objected to claim 1 on the basis that the phrase "a read gap material layer" in line 6 refers to one of the first and second read gap layers or to an additional layer. Claim 1 has been amended to recite:

"nonmagnetic electrically insulative first and second read gap layers wherein the first read gap layer includes a read gap material layer and first and second refill gap layers;"

The Applicant maintains that this amendment provides proper basis for the subsequent recitations regarding the read gap material layer and the first and second refill gap layers. Claim 2 has been amended to recite:

"the second read gap layer interfacing the sensor;"

which overcomes the Examiner's objection to claim 2. Claims 4 and 6 have been amended in the same manner as claims 1 and 2 hereinabove which should overcome the objections of the Examiner to claims 4 and 6.

Claims 1-7 were rejected under 35 USC 102(b) as being anticipated by Taniyama. Amended claim 1 is distinguished over Taniyama by reciting:

"the first and second refill gap layers being disposed in the first and second depressions and engaging a bottom portion of the first side wall and engaging a bottom portion of the second side wall respectively;

the first read gap layer having first and second portions which extend laterally from the first and second side walls of the sensor and a third portion which engages a bottom surface of the sensor and is located between said first and second portions;

each of said first and second portions having a thickness which is greater than a thickness of said third portion;"

This structure is shown in Applicant's Fig. 9 wherein the first and second refill gap layers 164 and 166 are disposed in the first and second depressions 160 and 162 and engage a bottom portion of the first side wall 138 and engage a bottom portion of the second side wall 139 respectively. Support for this structure is also found in Applicant's specification, page 4, lines 15-17 wherein it is stated:

" nonmagnetic electrically insulative first and second refill gap layers are sputter deposited into the first and second depressions, which refill gap material is also deposited on the first and second side walls of the sensor,"

As further shown in Fig. 9, the first read gap layer (G1) has first and second portions 150 and 152 which extend laterally from the first and second side walls 138 and 139 and has a third portion 76 which engages a bottom surface of the sensor 74 and is located between the first and second portions 150 and 152. Each of the first portions 150 and 164 and the second portions 152 and 166 of the first read gap layer has a thickness which is greater than a thickness of the third portion 76. In contrast, Taniyama's lateral portions 3 and 11 are not thicker than the central portion of the first read gap layer below his sensor 5 and 6. The advantages of Applicant's invention are discussed next.

By making the first read gap layer very thin, as shown in Fig. 9, the linear read bit density of the magnetic head 72 can be significantly increased. The risk, however, is pinholes in the first read gap layer (G1) which can short out to the hard bias layers 140 and 144 and thence to the lead

layers 142 and 146. The pinhole shorting problems have been overcome in Fig. 9 by depositing the refill gap layers 164 and 166 which make the lateral portions of the first read gap layer thicker than the central portion immediately below the sensor. While the risk of pinholes is still present for the central portion of the first read gap layer below the sensor, that problem no longer exists for the lateral portions of the first read gap layer. Accordingly, when the magnetic heads are tested after manufacture Applicant's magnetic heads with the structure shown in Fig. 9 will have less shorting problems and a higher manufacturing yield due to the refill gap layers 164 and 166 which eliminate the pinholes in these areas. The Applicant discusses these pinhole problems on page 3, lines 2-12 of his specification wherein it is stated:

"Consequently, it is important to minimize thicknesses of the first and second read gap layers so as to reduce the read gap between the first and second shield layers. A typical material for the first and second read gap layers is aluminum oxide (Al_2O_3). Unfortunately, when the read gap layers are made too thin pinholes in these layers cause electrical shorts between the shield layers and the first and second lead layers. For instance, if the first read gap layer has a pinhole this will cause a short between the first shield layer and one of the first and second lead layers to the sensor. This can be overcome by making the first read gap layer sufficiently thick so that a pinhole does not extend through the thickness of the layer. Making the aforementioned contiguous junction can present a problem in maintaining the first read gap layer with an optimized reduced thickness that is free of pinholes."

The pinhole problem is further discussed from page 3, line 27 to page 4, line 3 wherein it is stated:

" There is a strong-felt need to maintain an optimized narrow first read gap layer without the risk of pinholes while ensuring the removal of the sensor material layer extending laterally from the first and second side walls of the sensor and making a contiguous junction that has high electrical contact between the side walls of the sensor and the first and second hard bias and lead layers."

The thickness of the first and second refill gap layers 164 and 166 to overcome the pinhole problem is discussed at page 9, line 16 to 24 wherein it is stated:

"In Fig. 14 the ion milling has been continued until the alumina has been removed from at least a portion of the first and second side walls 138 and 139 so that these side walls are exposed for a subsequent electrical connection thereto. During the ion milling the alumina above the depressions 160 and 162 has also been milled. An aspect of the invention is that the alumina layer sputter deposited in Fig. 12 be sufficiently thick so that when the alumina is ion milled from the side walls 138 and 139 the top surfaces of the refill gap layers 164 and 166 provide a sufficient thickness to minimize shield shorts from the first shield layer 80 to the first and second hard bias and lead layers 134 and 136 in Fig. 9."

Claims 4 and 6 have been amended in a similar manner as claim 1 and are considered to be patentable over Taniyama for the same reasons as given in support for claim 1. Claims dependent upon claims 1, 4 and 6 are considered to be patentable over Taniyama for the same reasons as given in support for claims 1, 4 and 6.

The last sentence of the paragraph on page 8, lines 13-21 has been amended to recite:

"The first refill gap layers 164 and 166 are not located on a portion of the first and second side walls 138 and 139 so that the first and second hard bias and lead layers 134 and 136 make direct electrical contact with the sensor 74."

As discussed hereinabove and as shown in Fig. 9, a portion of the first and second side walls 138 and 139 is made available for the interfacing with the first and second hard bias layers 140 and 144. It is maintained that this amendment corrects an obvious error of the paragraph.

The paragraph beginning at page 9, line 25 to page 10, line 7 has been amended so that a middle sentence thereof now reads:

"In Fig. 16, chemical mechanical polishing (CMP) has removed the top portion of the carbon layer 174 above photo mask 200, vertical portions of the layers 174, 146 and 144, the photo mask 200 and a stop by the carbon layer 172, and then reactive ion etching (RIE) removes the carbon layer 172 on top of the sensor 74."

This structure is shown during the method steps in Figs. 15 and 16 wherein the chemical mechanical polishing (CMP) in Fig. 16 is stopped by the carbon layer 172 in Fig. 15, thence reactive ion etching (RIE) in Fig. 16 removes the carbon layer 172. The Applicant maintains that this amendment corrects an obvious error in the paragraph.

New claims 15, 16 and 17 which read on Applicant's species are dependent on claims 1, 4 and 6 respectively and are considered to be patentable over Taniyama for the same reasons as given in support for claims 1, 4 and 6. Claims 15, 16 and 17 are further distinguished over Taniyama by reciting:

"the top surfaces of the first and second hard bias layers and the sensor lying within a common plane."

The title has been changed "A HIGH LINEAR DENSITY READ HEAD WITH A CONTIGUOUS JUNCTION AND MINIMAL SHIELD SHORTS". The Applicant respectfully requests that the Examiner permit this amendment to the title since it is more descriptive of the article claims elected herein.

In the last sentence of paragraph 5 of the Office Action the Examiner states:

"Claim 6 recites the limitation "a first read gap layer" in line 18. It is unclear whether this limitation refers to the first read gap layer of claim 6, line 7, or to an additional layer."

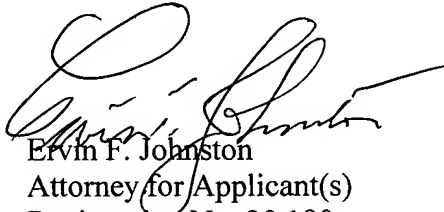
Claim 6, line 18 recites:

"the first read gap layer interfacing the first shield layer;"

This recitation refers to the first read gap layer recited in claim 6, line 7.

Should the Examiner have any question regarding this Amendment she is respectfully requested to contact the undersigned at **808-661-1195**.

Respectfully submitted,



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